NASA Technology Transfer Network Communications and Information System

TUNS USER SURVEY

RICIS Preface

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EXECUTIVE SUMMARY

Applied Expertise surveyed users of the deployed Technology Utilization Network System (TUNS) and surveyed prospective new users in order to gather background information for developing the Concept Document of the system that will upgrade and replace TUNS.

Survey participants broadly agree that automated mechanisms for acquiring, managing and disseminating new technology and spinoff benefits information can and should play an important role in meeting NASA technology utilization goals. However, TUNS does not meet this need for most users. For example, the survey found that:

- The current TUNS configuration fails to eliminate delays and bottlenecks that impede the reporting and dissemination of New Technology Reports.

- NASA benefits information is not systematically tracked and disseminated.

- Data entered into TUNS is often sketchy or of poor quality.

- New Technology Report (NTR) data is not useful to technology transfer centers in their task of sifting through data to find potential solutions.

- TUNS is a cumbersome system to search, both locally and on the central database.

- TUNS use is limited to a few NASA sites, which pass on a limited number of NTRs and benefit reports to the central database.

The survey describes a number of systemic improvements that will make it easier to use the technology transfer mechanism, and thus expedite the collection and dissemination of technology information. The Survey identified 26 suggestions for enhancing the technology transfer system and related processes. These include the following:

- Implement an open-architecture, modular system that allows all users to gain access to data regardless of their local environment and allows them to port data back and forth across other non-system databases and applications that may be in place.

- Streamline and modularize the current system to pare back the number of menus and data entry screens, and offer users only the modules they require.

- Make electronic forms available for researchers themselves to submit new technology information to Technology Utilization (TU) offices via electronic mail or other field center networks. This could eliminate effort expended in rekeying data and give the researcher

who is most familiar with the new technology the opportunity to create an accurate abstract for dissemination.

- Re-examine database categories for benefits to include non-quantifiable categories and potentially, to eliminate unnecessary data elements.

- Improve the process for uploading benefits so they are easy to collect and send.

- Explore ways in which some information about technology that is proprietary or is awaiting release may be made available on a restricted basis while still protecting the components of the information that must remain confidential.

- Simplify the central dial-up of the NTR database. In addition, the central NTR repository should be used to compile products such as CD-ROM or database update files that may be mailed monthly to technology transfer agents for convenient searching on their local machines.

Unless the system is designed for convenient searching of information, it will not be used and therefore will fail in its attempts to aid technology transfer. The survey found that technology transfer centers will eagerly use this system if it (i) provides new technology information from all field centers, (ii) requires only a few steps to gain access to the information and (iii) provides this information rapidly -- i.e., faster than it can be published and before it is available through other sources.

One Technology Utilization Officer (TUO) noted that the chief value of TUNS lies in making available to the Regional Technology Transfer Centers, other technology transfer agents and the public the full range of NTRs -- not merely those that are highly rated and therefore eligible for publication. Otherwise, he said, the effort invested in building the TUNS database is wasted. Conversely, all TUOs must contribute to the central database if it is to be of value to the RTTCs.

The 26 suggestions are listed in a survey index.

1.0 INTRODUCTION

1.1 Identification

This is a summary of the Technology Utilization Network System (TUNS) User Survey. The survey was conducted to obtain background for the Concept Document of the NASA Technology Transfer Network Communications and Information System, a system that will upgrade and replace TUNS.

1.2 Background

TUNS is a technology transfer mechanism designed to increase acquisition and dissemination of new technology information and decrease the time between acquisition and dissemination. TUNS serves as a central and local information resource. It is used by technology transfer centers and NASA Technology Utilization (TU) offices in their efforts to share NASA technology with public and private enterprises. TUNS also facilitates communication among Technology Utilization Division staff, increases the efficiency of TU administration and tracks technology transfer benefits.

TUNS has served its users for five years, but changing technology and expanded customer requirements provide compelling reasons to initiate a new effort to enhance and upgrade TUNS.

1.3 Purpose and Objectives

The survey was directed toward identifying processes and elements of TUNS that require modification to better meet these goals:

a. Increase and accelerate new technology reporting and benefits reporting.

b. Enhance quality and accuracy of technology transfer information.

c. Improve access to technology information.

d. Increase and expand the use of the system in NASA and other R&D programs.

The survey provides an input for writing a Concept Document for a new and improved technology transfer mechanism.

1.4 Scope and Methodology

In addition to reviewing the current TUNS configuration and process, Applied Expertise met with staff from 13 user sites, including seven field center Technology Utilization (TU) offices, two Regional Technology Transfer Centers (RTTCs) that were also Industrial Application Centers (IACs) during TUNS' development, the National Technology Transfer Center (NTTC) and three

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technology transfer contractors. In addition, phone interviews were conducted with information services staff at the four remaining RTTCs. (See Appendix 3.) Interviews were conducted using structured techniques on a not for attribution basis. Potential users as well as existing users of the system were interviewed, and both management and technical issues were discussed. However, the survey focused primarily on the application and use of TUNS. This methodology was used to assure that the positive and negative views of those most involved with TUNS would be given adequate consideration.

This document summarizes the results of the interviews, including problems identified during these discussions and suggestions made by Applied Expertise. Several of the problems identified cannot be remedied merely by technical solutions. In other cases, technical solutions are only a partial answer to non-technical problems at some sites. At other sites, conditions identified indicate a clear and compelling need for upgrading and modifying the currently deployed technology.

2.0 SURVEY FINDINGS

This section summarizes major survey findings for each of the goals outlined in Section 1.3, and it summarizes suggestions for improvement made by survey participants and Applied Expertise. (Appendix 1 provides an index of all suggestions.)

2.1 Goal 1: Increase and Accelerate New Technology Reporting and Benefits Reporting

The current TUNS configuration fails to eliminate delays and bottlenecks that impede the reporting and dissemination of New Technology Reports (NTRs). A key impediment at some sites is the existence of TUNS-incompatible hardware and software. In addition to technical obstacles, there are a number of management obstacles, including limited staff resources, patent regulations, and a higher priority placed on the publication of NTRs as Tech Briefs than on central collection of all NTRs -- including those that have been published, those that are awaiting publication and those that will not be published. As a result of these obstacles, the flow of technology information is delayed and constricted. In addition, benefits information is not systematically tracked and disseminated because follow-up of technology transfer activities is time-consuming and complicated, and because guidance is lacking on what information should be provided. As a result, the opportunity to document the value of NASA research activities is lost. The following analysis reflects the results of our discussions and interviews.

2.1.1 Sites not using TUNS

In some cases, the field centers' TU offices do not use the information system to track and record NTRs, or they use it only occasionally in conjunction with manual logging and filing systems or with separate off-the-shelf databases. In general, Industrial Application Centers did not use TUNS either for searching for new technology or to report benefits. Use at these sites was limited for a number of reasons:

- Installed hardware is incompatible with TUNS, e.g. Macintosh machines. In at least one instance, an office uses a variety of machines that are not networked, limiting the utility of the system at this site.

- Limited staff resources are available to devote to learning the system and to maintaining local TUNS databases and building the central database.

- The system is too complex. One TU staff member said co-workers found the extensive number of databases, menus, options and fields within a database form "frightening."

- The TU offices and RTTCs have access to other off-the-shelf software that can be easily tailored to meet the requirements of the individual office. Many users emphasized that they do not want to be "locked in" to particular applications software.

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- TU offices perceive little or no benefit to the field center in devoting resources to the collection and input of requested information into TUNS.

- RTTCs/IACs perceive little benefit in participating in TUNS because the key feature for them, the central repository, was implemented last. Once it was available, difficulty of searching it further discouraged active use.

2.1.2 Creating abstracts

TU staff members generally create NTR abstracts based on a variety of data sources, including technical papers and patent disclosure forms. They then input the abstracts into TUNS. Often, non-technical staff prepare these abstracts. It is a time-intensive activity that impedes the rapid flow of NTRs to the public.

2.1.3 Regulatory impediments

The contractor data rights clause can delay NTR reporting by up to three years. Under this clause, an innovator may take two years to decide whether to waive his rights to the invention and up to one year after that to file for a patent. It is burdensome and time-consuming for staff to track NTRs over this length of time. Consequently, at least one TU office does not release contractors' NTRs unless they were first published in Tech Briefs. At this center, technology reports in which rights are waived three years from initial reporting, as well as those without a sufficient rating to warrant publication, do not enter the Central TUNS database. In addition, it is generally left to TU offices to ensure that contractual requirements to report new technology are met. This requires substantial time and effort.

2.1.4 Focus of efforts on publication in Tech Briefs

Many TU offices place primary emphasis on placing items in NASA's Tech Briefs magazine. Many indicated that their performance is judged on this basis. Consequently, some staff members use TUNS primarily as a mechanism for tracking the status of innovations headed for publication. However, increasing backlogs in the evaluation and publication processes have extended the average time between receipt and publication of New Technology Reports to at least two years. Few centers have emphasized the timely release of NTRs to the central TUNS database. Yet a central data repository, if supported, could make more information than can be published available to technology transfer agents and it could make the information available faster.

2.1.5 Lack of standard reporting mechanism for benefits

Technology transfer agents recognize the importance of demonstrating the spinoff benefits to the public that result from NASA technology. However, the realization of benefits can be on very long time cycles -- beyond the ability and resources of centers to track. It may take five years, 10 years or even longer for a company to successfully develop an application of NASA

technology. This poses difficulties for center follow-up. It may be difficult to determine the optimal time to contact the client. For instance, follow-up that occurs too soon will not likely result in benefits reporting, but follow-up calls too long after the service was provided are less likely to find the original contact still working on the project.

In practice, a technology transfer center follows up with its clients on an ad hoc basis as time allows to see what benefits were received. One center records the result of its client benefits interviews manually and stores them in a binder. Thus, even where benefits are collected, they are not entered into TUNS. The benefits realized may have little to do with NASA technology because the center will provide many services of potential benefit to the client that do not directly relate to providing technical solutions. Consequently, there is little incentive for center staff to provide benefits information systematically because it fails to reflect the range and extent of services provided to clients.

2.1.6 Dissatisfaction with benefits database

Several RTTC staff members expressed disappointment in the benefits database fields, which do not include categories for "soft" benefits, i.e., those that cannot be expressed in dollar amounts, such as the value of expanding the client's information base and of providing input to customer decision making. Even for those reports that are likely to result in quantifiable benefits, this information is difficult to obtain, and the estimates may not be reliable. Consequently, few benefit reports include quantifiable data. One staff member added that "soft" categories, if included, must be perceived as being of equal value to quantifiable benefits.

2.1.7 Conclusions and Suggestions

On the basis of our analysis of the current TUNS and our survey of TUNS' users, we believe that a number of systemic improvements will make it easier to use the system
and thus expedite the collection and dissemination of technology information. With regard to NTRs, we suggest that the Concept Document for the successor system provide a foundation for:

a. Implementing an open-architecture, modular system that allows all users to gain access to data regardless of their local environment and allows them to port data back and forth across other non-system databases and applications that may be in place.

b. Streamlining and modularizing the current system to pare back the number of menus and data entry screens, and offer users only the modules they require. We also suggest that the forms within the remaining modules be simplified.

The Concept Document should consider alternatives to alleviate the TUNS data entry bottleneck. These alternatives include:

c. Making electronic forms available for researchers themselves to submit new technology information to TU offices via electronic mail or other field center networks. This could

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eliminate effort expended in rekeying data and give the researcher who is most familiar with the new technology the opportunity to create an accurate abstract for dissemination. A number of field centers indicated that this would be useful. Some already are receiving new technology information via electronic mail. Other field centers believed this would increase the burden on the researcher and create a new disincentive for submitting information.

d.   Providing optical character recognition capabilities (OCR) to field centers that want it. This would reduce rekeying, although some quality checking would still be necessary. Also, it would not free TU staff from creation of abstracts unless these were provided in their source information.

e.   Having contractors or a network service center create abstracts. Some field centers have already chosen this option (e.g., by using ICT).

With regard to benefits, we suggest that the Concept Document for the successor system provide a foundation to:

f.   Re-examining database categories for benefits to include non-quantifiable categories and potentially, to eliminate unnecessary data elements.

g.   Improving the process for uploading benefits so they are easy to collect and send.

Other potential solutions fall outside the scope of the new information system and thus are not reflected in the Concept Document. We suggest:

h.   Creating a comprehensive, standard questionnaire to help technology transfer centers elicit and standardize responses on benefits from their clients.

i.   Holding workshops for in-house researchers and promote awards ceremonies to coincide with Tech Briefs awards. This has helped a number of TU offices successfully increase the visibility and participation in their programs.

j.   Recognizing the efforts of TU offices based not only on the number of Tech Briefs published from the center in a given month but also on the increase in a center's volume of NTRs, as well as other exceptional accomplishments.

k.   Exploring ways in which some information about technology that is proprietary or is awaiting release may be made available on a restricted basis while still protecting the components of the information that must remain confidential.

2.2 Goal 2: Enhance Quality and Accuracy of Technology Transfer Information

Data entered into TUNS is often sketchy or of poor quality because people with different skills, backgrounds, knowledge and commitment to TUNS produce this data. Limited staff time and limited availability of complete information also degrades data quality. Resultant flaws or inconsistencies limit TUNS' usefulness.

Currently, NTR data is not useful to technology transfer centers in their task of sifting through data to find potential solutions. This is primarily attributable to the system's lack of flexibility, the difficulty associated with searching the mainframe-based central database, and the meager data residing there. To have utility, one RTTC staff member said, the NTR data would have to be well-indexed, and staff would have to be able to look at the data in a variety of ways without difficulty. The NTR needs to provide specifications of new technologies' operating and performance capability.

One TU office had little confidence in the quality of data in Central TUNS, and one staff member regards it as "this hole you put data into." Spelling errors in the keyword list hamper local as well as central searching. To compensate, one user obtained a keyword list to refer to, but the list is not accessible from the system itself. This lack of confidence extends to potential use of the quarterly report mechanism. If everyone does not contribute to the quarterly report in a standard fashion, none of the data will be useful, and the data cannot be used to prepare consistent center activities reports, according to this TUO.

2.2.1 Incomplete or inconsistent data

- One example of inconsistency is the failure of some field centers to use the NASA thesaurus when entering keywords. The staff at one center said they felt this made the keyword field useless and limited their confidence in data from outside their center. Some records have no keywords, and one staff member noted this as a significant shortcoming in the data.

- Another reason sketchy or inconsistent information is entered in TUNS is varying interpretations of what is required for a given field. One TUO staff member said some of the database fields were ambiguous, and that led to different interpretations even among in-house staff as to how a given field should be completed.

- Another remarked that the quality of the source information varied widely. In some cases, handwritten technology reports and drawings are submitted, affecting the accuracy and speed with which the reports can be processed.

- The problem of different interpretations for database fields is exacerbated by TUNS. Several users commented that the system has too many fields and too many data entry screens.

2.2.2 Quality of Abstracts

- One staff member was concerned that having non-technical staff compose technology abstracts affects data quality and accuracy.

- RTTCs and the NTTC are looking for sources of information that are technology- rather than project-oriented. The abstract should provide detail on the capabilities and characteristics of a technology rather than general statements about project goals. The source of the technology and appropriate contacts should be explicit.

2.2.3 Conclusions and Suggestions

Because of differences in field center environments and in the way TU offices work, no one solution to problems of data quality and consistency will answer for all sites. However, many sites may find these alternatives helpful.

l. Encouraging electronic mail submission of NTRs by researchers or electronic (i.e., OCR) scanning of documents. These options would reduce some errors by eliminating extensive rekeying. It would also reduce errors by placing more responsibility for producing information on the individuals most familiar with the subject matter.

m. Producing abstracts through a central network service center. Some TU offices would not find e-mail submission helpful, preferring not to place added burdens on researchers. For these offices, a network service center could be set up to produce abstracts from technical reports and send them to the appropriate TUO electronically for loading into local databases. This alternative would aid in promoting consistency across database records.

n. Deciding on standard procedures. Some problems of inconsistency and incomplete information should be worked out among TU offices. For instance, some offices have decided on standard responses for given database fields. Others have quality checking procedures in place. At a minimum, use of the NASA thesaurus for keyword entries should be standard.

o. Increasing the utility of the data to technology transfer clients through discussions between the end users of the system (RTTCs/NTTC) and TU staff. Such discussions would help determine critical database elements and criteria for abstract completeness.

2.3 Goal 3: Improved Access to Technology Information

2.3.1 General

TUNS is a cumbersome system to search, both locally and on the central database. One member of the TU staff said that if you wanted data from Central TUNS, it was better "to drive up [to NASA Headquarters] than to dial in." Also, it does not provide a convenient means for creating custom reports that aid in management of NTRs. Lack of an accessible keyword list hampers searching. As a result, only proactive users who are creative in applying technical solutions to the problem are able to extract what they need from TUNS.

What makes TUNS searching cumbersome is an inadequate user interface, the inconvenience of dialing into a slower central computer for the information, and the multiple screens of information that must be browsed by paging through the system. "It's so big you tend to lose what's in there," one user said.

It is tedious to load records onto TUNS, and it is tedious to browse TUNS. The system is limited to uploading and downloading 18 records at a time. This is because of the limits of the current dial-up configuration to the mainframe -- bottlenecks are unavoidable with current TUNS hardware, software and interfaces.

One RTTC staff member reported that it is difficult to access the central mainframe, requiring several steps. In addition, the search mechanism is very rigid. For instance, the case sensitivity of the Unify database product increases the frustration of users. It is much easier to access the NASA RECON database, as well as the 10 to 11 other commercial databases that the center relies upon for technology information. Consequently, the effort that TUOs put into compiling NTRs and uploading them to Central is wasted, and nobody is benefiting from this effort.

2.3.2 Conclusions and Suggestions

Unless the system is designed for convenient searching of information, it will not be used and therefore will fail in its attempts to aid technology transfer. RTTCs will eagerly use this system if it (i) provides new technology information from all field centers, (ii) requires only a few steps to gain access to the information and (iii) provides this information rapidly -- i.e., faster than it can be published and before it is available through other sources. We suggest:

p. Simplifying central dial-up of the NTR database. In addition, the central NTR repository should be used to compile products such as CD-ROM or database update files that may be mailed monthly to technology transfer agents for convenient searching on their local machines. RTTCs have expressed interest in each of these options, and most stated that their preferences for one medium over another would be based on relative cost. However, many RTTCs expect to install CD readers, either in their offices or portable systems that can be used in the field.

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q. Providing CD-ROM to NASA innovators and managers as well. This would serve the dual function of giving innovators information about research going on throughout NASA, thus preventing duplication of effort, and also providing an incentive to researchers to contribute information on their own work.

r. Making available easy search tools with quick access to the keyword list.

s. Making the benefits database readily available and in easily searchable form. This information is often used in speaking engagements and presentations. Having this information at their fingertips might serve as an incentive to technology transfer agents to provide benefits information derived from their own activities.

2.4 Goal 4: Increase and Expand System Use in NASA and Other R&D Programs

Use of TUNS is limited to a few NASA sites, which pass on a limited number of NTRs and benefit reports to the central database. Thus, opportunities to glean more information from NASA programs and to expand dissemination outside the regional technology transfer centers are lost. Yet, for the TUO that is concerned mainly with using the system to manage NTR collection at his center for eventual Tech Briefs publication, there is no compelling reason to increase dissemination. Wider access to NTRs may increase the workload of the TU staff, requiring them to answer more requests and to prepare technical support packages for NTRs that have not been published in Tech Briefs, a task they do not now have to do. Some TU staff members also expressed concern that wider dissemination would mean a loss of control over the information.

2.4.1 Expanded Use at TU Offices

Broader use of TUNS within sites is often limited by the lack of a clear understanding of TUNS' functions. Many of its modules are not used because of the system's complexity. Training and support have been inadequate to learn how to use this system, a TU staff member said. She added that she does not have time to devote to experimentation and exploration of TUNS' capabilities on her own. Lack of contractor support continuity and lack of resources for on-site training have impeded the success of TUNS.

2.4.2 Needs of Potential TU Users

RTTCs have articulated several information system needs that TUNS does not now satisfy:

a. Rapid access. The industry clients to NASA's technology transfer centers demand information that represents the cutting edge so they can make long-term business plans and so they can avoid investing in duplicate research and development efforts. Therefore, although technology that has been available for an extended period of time may be useful for many businesses' specific needs, RTTCs will judge the system based on its ability to provide new technology information fresh off the vine.

b. Access to NASA-wide information. Unless all or most field centers contribute to a central database, the system's utility for RTTCs is limited.

c. Experts database. Several RTTCs expressed interest in data on information that identifies experts and their specific areas of expertise. One staff member said the RTTC would use this database for "cross-fertilization" of its own client database, electronically matching potential contacts with industry requests. While many long-time members of the TU community said they preferred to identify experts through their established community contacts and over the phone, both new and old participants were interested in an up-to-date, on-line source of expert information.

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d. Financial reporting requirements. Both long-standing and new members to the TU community expressed a desire for guidance in what management information should be provided in required reports, in what format it is needed, and how this might affect RTTC information systems requirements.

e. Benefits reporting requirements. All RTTCs have at least initially discussed follow-up and evaluation of the services they provide to their clients. As RTTCs form these plans, guidance is desirable on what benefits information should be provided and in what format.

f. Macintosh support. Many RTTCs are contemplating including Macintosh desktop and portable computers in their information systems plans, adding to the number of existing Macintosh users within the TU community.

g. Graphics. While recognizing that cost and performance trade-offs may prohibit or delay electronic handling of graphic information (e.g., schematics of a device), some technology transfer centers said this capability ought to be provided and would be very useful.

h. Links to additional information on-line. In addition to graphics, RTTC staff expressed an interest in full-text access to source information. While several TU and RTTC staff said it was acceptable to get this information through phone calls and the mail, others disagreed. "It seems foolish to throw away all the data and go back to the original source," one staff member said.

2.4.3 System Use Outside TU Community

Broader use of TUNS outside the TU community is hampered by the current mainframe-based configuration. In addition, the TU community needs to discuss which information in the NTR database is appropriate to share with non-TU users.

2.4.4 Conclusions and Suggestions:

As one TUO noted, the chief value of TUNS lies in making available to the RTTCs, other technology transfer agents and the public the full range of NTRs -- not merely those that are highly rated and therefore eligible for publication. Otherwise, he said, the effort invested in building the TUNS database is wasted. Conversely, all TUOs must contribute to the central database if it is to be of value to the RTTCs. The following suggestions are designed to encourage widespread use of the new system:

t. Using off-the-shelf software that requires small investments in learning time to the greatest extent possible. The new system ought to decrease system complexity and must absolutely avoid replacing the current complexity with a new one. This will enable staff to use the

system more often and more efficiently and give them the means for trouble-shooting simple problems themselves.

u. Providing consistent and anticipatory user support. One RTTC staff member suggested that a user committee be set up to ensure that contractors receive user feedback throughout system development. This is crucial to gaining and keeping users, he said. He noted that NASA risks wasting effort by delivering systems *fait accompli* without consulting targeted users throughout development.

v. Disseminating through other vehicles, such as a program newsletter, information to keep all users informed about the progress of system development, provide tips, discuss how problems have been solved and feature new technology highlights. On-site training should be available as needed.

w. Exchanging new technology information between NASA programs and other federal R&D agencies such as the Department of Energy, the National Technology Transfer Center, and the Federal Laboratory Consortium. This can be facilitated by dissemination of CD-ROM or through SQL database updating techniques.

x. Enabling NASA innovators to contribute information electronically and also to receive central NTR database information in locally searchable form.

y. Promoting the new system across NASA and other federal R&D agencies so that potential users are as familiar with it as they are with other widely recognized databases, such as NASA RECON.

z. Sharing decisions with RTTCs on whether the new system will support RTTC reporting requirements and what impact this is likely to have on RTTCs' choices of hardware platform and applications software.

APPENDIX 1 - SUGGESTION INDEX (page #)

a.   Implementing an open-architecture, modular system that allows all users to gain access to data regardless of their local environment and allows them to port data back and forth across other non-system databases and applications that may be in place. (5)

b.   Streamlining and modularizing the current system to pare back the number of menus and data entry screens, and offer users only the modules they require. We also suggest that the forms within the remaining modules be simplified. (5)

c.   Making electronic forms available for researchers themselves to submit new technology information to TU offices via electronic mail or other field center networks. This could eliminate effort expended in rekeying data and give the researcher who is most familiar with the new technology the opportunity to create an accurate abstract for dissemination. A number of field centers indicated that this would be useful. Some already are receiving new technology information via electronic mail. Other field centers believed this would increase the burden on the researcher and create a new disincentive for submitting information. (6)

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g.   Improving the process for uploading benefits so they are easy to collect and send. (6)

h.   Creating a comprehensive, standard questionnaire to help technology transfer centers elicit and standardize responses on benefits from their clients. (6)

i.   Holding workshops for in-house researchers and promote awards ceremonies to coincide with Tech Briefs awards. This has helped a number of TU offices successfully increase the visibility and participation in their programs. (6)

j.   Recognizing the efforts of TU offices based not only on the number of Tech Briefs published from the center in a given month but also on the increase in a center's volume of NTRs, as well as other exceptional accomplishments. (6)

k.   Exploring ways in which some information about technology that is proprietary or is awaiting release may be made available on a restricted basis while still protecting the components of the information that must remain confidential. (6)

l.   Encouraging electronic mail submission of NTRs by researchers or electronic (i.e., OCR) scanning of documents. These options would reduce some errors by eliminating extensive rekeying. It would also reduce errors by placing more responsibility for producing information on the individuals most familiar with the subject matter. (8)

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o. Increasing the utility of the data to technology transfer clients through discussions between the end users of the system (RTTCs/NTTC) and TU staff. Such discussions would help determine critical database elements and criteria for abstract completeness. (8)

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q. Providing CD-ROM to NASA innovators and managers as well. This would serve the dual function of giving innovators information about research going on throughout NASA, thus preventing duplication of effort, and also providing an incentive to researchers to contribute information on their own work. (10)

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s. Making the benefits database readily available and in easily searchable form. This information is often used in speaking engagements and presentations. Having this information at their fingertips might serve as an incentive to technology transfer agents to provide benefits information derived from their own activities. (10)

t. Using off-the-shelf software that requires small investments in learning time to the greatest extent possible. The new system ought to decrease system complexity and must absolutely avoid replacing the current complexity with a new one. This will enable staff to use the system more often and more efficiently and give them the means for trouble-shooting simple problems themselves. (13)

u. Providing consistent and anticipatory user support. One RTTC staff member suggested that a user committee be set up to ensure that contractors receive user feedback throughout system development. This is crucial to gaining and keeping users, he said. He noted that NASA risks wasting effort by delivering systems *fait accompli* without consulting targeted users throughout development. (13)

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discuss how problems have been solved and feature new technology highlights. On-site training should be available as needed. (13)

w.   Exchanging new technology information between NASA programs and other federal R&D agencies such as the Department of Energy, the National Technology Transfer Center, and the Federal Laboratory Consortium. This can be facilitated by dissemination of CD-ROM or through SQL database updating techniques. (13)

x.   Enabling NASA innovators to contribute information electronically and also to receive central NTR database information in locally searchable form. (13)

y.   Promoting the new system across NASA and other federal R&D agencies so that potential users are as familiar with it as they are with other widely recognized databases, such as NASA RECON. (13)

z.   Sharing decisions with RTTCs on whether the new system will support RTTC reporting requirements and what impact this is likely to have on RTTCs' choices of hardware platform and applications software. (13)

APPENDIX 3 - ACKNOWLEDGEMENTS

APPENDIX 2 - ABBREVIATIONS AND ACRONYMS

CD-ROM   Compact disk read only memory (optical storage)
DBMS   Database management system
IAC   Industrial Application Center
LAN   Local area network
NTR   New Technology Report
NTTC   National Technology Transfer Center
OCR   Optical character recognition
RTTC   Regional Technology Transfer Center
TCIS   NASA Technology Transfer Network Communications and Information System (pronounced TEE-sis, to rhyme with *thesis*)
TU   NASA Technology Utilization Division, or Technology Utilization
TUNS   Technology Utilization Network System
TUO   Technology Utilization Office or Technology Utilization Officer